Benthic Community Dynamics in Galveston Bay, Texas

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Dr. Rowe received his B.S. and M.S. degrees from Texas A&M (1964 and 1966) and a Ph.D. from Duke University(1968). His professional experience has included 10 years at the Woods Hole Oceanographic Institution, 8 years at the Brookhaven National Laboratory and 11 years at Texas A&M, where he is presently a Professor of Oceanography. Dr. Rowe has published over 100 scientific or technical papers, in addition to editing or co-authoring several volumes devoted to deep-sea life. He and his students, including summer undergraduate research teams from 1994 to 96, have investigated the ecology of bottom communities in Galveston Bay since 1990. Emphasis has been on relating the natural recycling of organic matter in relation to ecosystem structure and function.

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Galveston Bay is a large, warm-temperate estuary that is rich in fisheries resources because of its high biological productivity. As a shallow estuary with a mean depth of approximately 2 to 3 meters (6 to 10 feet), as in most shallow water ecosystems," benthic-pelagic coupling" (an interdepentdent exchange of nutrients between the water and the sediments) is presumed to have a dominating influence on ecosystem productivity in Galveston Bay. Regional ecologists however disagree about the rates of sediment-water exchanges of biological metabolites over much of Galveston Bay. Whether such rates are intense or not in Texas estuaries, including Galveston Bay, is important to state water resource managers who regulate freshwater flow from rivers into the headwaters of the estuaries.

In the studies reported here, sediment oxygen consumption (SOC) and inorganic nutrient production have been measured in in situ benthic incubation chambers across a representative range of environmental conditions in the sediments of Galveston Bay. The experimental chambers are set in place by SCUBA divers from Texas A&M's Department of Oceanography. The scientific divers, mostly graduate students or their faculty advisors, resample the water in the chambers every few hours using hypodermic syringes. The water samples are then analyzed aboard ship or back at University laboratories in College Station or at Fort Crockett in Galveston. Estimates of community biomass (macrofauna, meiofauna and bacteria) were made at the same sites using diver-held grab or core sampling, followed by laboratory sorting and biomass determinations. The bacteria in the sediments were stained and counted directly using an epifluorescent microscope in College Station. In these investigations, the mean of the community metabolism, which includes anaerobic processes, was high (49.8 mmol oxygen consumed/m^2 -day; equal to 508 mg C /m^2 -day), but the mean total community biomass was relatively low (5.8 g C /m^2, including sulfate reducing bacteria), indicating that the "total" biota were characterized by a rapid mean turnover time (ca.11.4 days). The bacteria, living in the pore water as well as on silt and clay-sized grains of the sediments, dominated the biomass. The net flux of regenerated inorganic nitrogen, mostly in the form of NH4+, had a mean value of 4.9 mmol N /m^2 -d, which is believed to be a significant source of nitrogen for photosynthetic organisms. It is suspected that about 25 to 50% of the potential nitrogen feedback is actually lost in the form of N2 gas due to denitrification. Photosynthesis by pennate diatoms on the sediment surface can be exceptional when light conditions permit, and this is believed to contribute to the bay's high biological activity. It is hypothesized that the low biomass of the macrofauna may be a result of "top down" predation, probably by shrimp.